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ABSTRACT

This electromechanical technician curriculum covers the following general areas: (1) basic soldering; (2) reading diagrams and following schematics; and (3) repairing circuitry and mechanics common to major appliances, vending machines, amusement equipment, and small office machines. The manual includes the following sections: (1) course description; (2) general objectives; (3) objectives--grades 9, 10, 11, and 12; (4) 35 major units of theory; (5) electromechanical competencies; (6) exploratory course outline; (7) student progress record form; (8) Connecticut's common core of learning; (9) student progress record book; and (10) 181 print and audiovisual references. (NLA)

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ELECTRO-MECHANICAL CURRICULUM

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PREPARED FOR:

CONNECTICUT STATE DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION
VOCATIONAL-TECHNICAL SCHOOL SYSTEM
MIDDLETOWN, CONNECTICUT

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TABLE OF CONTENTS

Course Description iii

General Objectives 1

Objectives By Grade 2

Major Units of Theory. 4

Competencies 5

Common Core 23

Student Record Book 37

Bibliography 66

COURSE DESCRIPTION

Upon completion of the Electro-Mechanical course, the student will be able to perform any one or all of the specializations at the apprentice level. The Electro-Mechanical technician will be proficient and trained in the following areas: basic soldering, reading diagrams and following schematics, repairing circuitry and mechanics common to major appliances, vending machines, amusement equipment, and small office machines. Much of the work will involve trouble shooting and work on actual field equipment. The student will have the opportunity to test and adjust machines as well as to build proto types of specialized equipment. The student will be trained in the use of the tools of the trade as well as the test equipment used in servicing Electro-Mechanical equipment. The student will be trained in standard business practices used in the industry.

GENERAL OBJECTIVES

The objectives of the Electro-Mechanical course are concerned mostly with qualifying the student for fruitful employment upon graduation. However, it is hoped that through experience in the field, the student will elect to continue formal education in a Technical Institute or Junior College, thus being provided with the necessary tools to remain more competent in the field of Electro-Mechanical devices.

The Electro-Mechanical course of study will provide the student with the skills, knowledge, and ability to successfully compete in the field of Electro-Mechanical devices.

It will also prepare the student to realize that change is natural, and that to compete in our modern world, the ability to change and learn new skills is paramount.

OBJECTIVES: GRADE 9

1. Students learn to appraise individual and unique interests, aptitudes, abilities, and skills while exploring a variety of specific trade-oriented experiences.
2. Students gain first-hand knowledge, understanding, and appreciation of employment patterns and opportunities in the changing world of work.
3. Students understand the basic processes of production, processing, and distribution in the American work economy and the importance of human relations and ingenuity in these processes.
4. Students achieve greater job satisfaction as a result of wise occupational choices.

OBJECTIVES - GRADE 10

After completion of the 10th grade, students will be able to:

1. Work safely.
2. Work proficiently with the tools and measuring devices of the trade.
3. Apply basic concepts of electricity, circuits, and mechanical devices.
4. Make informed determinations on the ooportunities of the occupation.
5. Apply the basic safety rules and procedures of the trade, including current OSHA requirements.

OBJECTIVES - GRADE 11

After completion of Grade 11, students will be able to:

1. Apply the basic safety rules and procedures of the trade.
2. Work proficiently with the tools and basic test equipment of the trade.
3. Apply basic concepts of electricity, circuits, and mechanical devices.
4. Make valid judgments on the job as to opportunities in the various allied trades.

OBJECTIVES - GRADE 12

After completion of Grade 12, students will be able to:

1. Install and service electro-mechanical equipment and basic electronic devices at the apprentice level.
2. Apply ethical business practices.
3. Practice good customer relations and sales techniques.
4. Maintain basic safety techniques as required in the trade.

MAJOR UNITS OF THEORY

1.1 Exploratory and Orientation

2.1 Electron Physics

2.2 Basic Concepts of Electricity

3.1 Semiconductors

3.2 Rectification

3.3 D. C. Generators

3.4 D. C. Motors

4.1 A. C. Fundamentals

4.2 A. C. Motors

4.3 Capacitors

4.4 Principles of Transformers

4.5 Motor Controls

5.1 Drives

5.2 Cams and Levers

5.3 Lubricants

5.4 Springs

6.1 Gases

6.2 Electric Heating

6.3 Electric Hot Water Heater

6.4 Electric Range

6.5 Electric Clothes Dryer

6.6 Electric Dish Washer

6.7 Automatic Washer

MAJOR UNITS OF THEORY

6.8	Trash Compactor
6.9	Microwave Oven
7.1	Refrigeration Principles
8.1	Hydraulic Systems
9.1	Pneumatic Systems
10.1	Robotics
11.1	Electro-Mechanical Systems
12.1	Manuals - Bulletins - Diagrams
13.1	Installations
14.1	Trouble Shooting
15.1	Preventive Maintenance
16.1	Customer Relations and Business Practices

ELECTRO-MECHANICAL

COMPETENCIES

1.1 Exploratory - Orientation

A. Career
   1. list opportunities for employment
   2. Apprenticeship Program

B. Shop rules and regulations
   1. list school rules
   2. list shop rules

C. Safety
   1. personal safety
      a. describe effects of electrical shock
      b. list shock avoidance techniques

   2. shop safety procedures
      a. describe shop organization
      b. demonstrate proper tool care
      c. demonstrate correct tool operation
      d. types of tools
         1. hand tools
         2. power tools

   3. correct and appropriate shop activities

D. Mechanical
   1. soldering
      a. describe procedure
      b. discuss problems
      c. identify types of solder
   2. wiring
      a. identify wire sizes
      b. identify types of wire insulations
      c. identify wire terminals and connectors
      d. wire simple basic electrical circuits
   3. construction
      a. identify and differentiate between series and parallel circuits

2.1 Electron Physics

A. Define terms
   1. atom, element, molecule, electron, proton, neutron, nucleus, ion, conductor, insulator, valence

B. State electrical charges
   1. atom, electron, proton, neutron, ion

C. Identify by valence
   1. conductors
   2. insulators
   3. semiconductors

2.2 Basic Concepts of Electricity

A. Like and unlike charges
   1. transfer of electrons
   2. reaction
   3. static electricity

B. Sources of electricity
   1. chemical action (battery)
   2. friction
   3. heat
   4. light
   5. pressure (piezo)
   6. magnetic-mechanical
   7. types of current

C. Meaning of voltage, ohm, ampere, watt
   1. ampere
   2. voltage
   3. ohm
   4. watt
   5. meter application

D. Ohm's law
   1. calculations
   2. relations

E. Magnetism
   1. characteristics
   2. behavior

F. Meters
   1. construction
   2. operation
   3. types
   4. A.C. vs D.C.
   5. connections

G. Protective devices
   1. fuses
   2. breakers
   3. thermal overloads
   4. ground fault interruptors

H. Reading, drawing and interpreting diagrams
   1. line diagram
   2. wire diagram
   3. cable (block) diagram
   4. pictorial diagram
   5. electrical symbols
   6. schematic diagrams

I. Series circuits
   1. relation of E.I.R.W.
   2. formulas

J. Parallel circuits
   1. relation of E.I.R.W.
   2. formulas

K. Series-parallel circuits
   1. calculation
   2. formulas S.I.R.W.

L. Conductors and insulators
   1. sizes
   2. types

M. Electro-magnetism
   1. characteristics
   2. relate to current flow
   3. construction

N. Solenoids
   1. characteristics
   2. uses

O. Relays and magnetic switches
   1. uses
   2. circuits

P. Control devices
   1. construction (electrical and mechanical)
   2. uses
   3. circuits

Q. National electrical codes (Basic information)
   1. definition
   2. grounding
   3. wire methods

3.1 Semiconductors

A. Diodes -- rectifiers S.C.R.
B. Transistors
C. Integrated circuits
D. Symbols

3.2 Rectification (Power Supplies)

A. Half-wave
B. Full-wave
C. Bridge
D. Filters
E. Regulation

3.3 D.C. Generators

A. Principles of operation
B. Types
C. Circuit application

3.4 D.C. Motors

A. Principles of operation
B. Types
C. Circuit application

4.1 A.C. Fundamentals

A. Generation of A.C.
B. Lenz's law and effects
C. Inductance
D. Capacitance

4.2 A.C. Motors

A. Principles of operation
B. Types
C. Circuit application

4.3 Capacitors

A. Construction
B. Uses
C. Testing
D. Discharging and charging
E. Circuit application

4.4 Principles of Transformers

A. Construction
B. Connections
C. Primary and secondary circuit relations
D. Volt, Amp relations
E. Step-up and step-down

4.5 Motor Controls

A. Magnetic control
B. Relays
C. S.C.R. controls
D. Thermostatic control
E. Mechanical control
F. Braking

5.1 Drives

A. Driver and driven
B. Pulleys and gears
C. Speed relations
D. Belt types and characteristics
E. Friction drives
F. Transmissions

5.2 Cams and Levers

A. Types
B. Uses

5.3 Lubricants

A. Types
B. Uses and applications

5.4 Springs

A. Classification
B. Application

6.1 Gases

A. Sources and types
B. Characteristics
C. Mixtures
D. Orifices
E. Ventilation
F. Draft
G. Heat and effects
H. Valves

6.2 Electric Heating

A. Types
B. Uses

6.3 Electric Hot Water Heater

A. Use charts and manuals
B. Wire electric heater
C. Check, test, replace heater elements
D. Check, test, replace heater controls

6.4 Electric Range

A. Use charts and manuals
B. Replace or repair panel parts.
C. Check, test, replace surface unit
D. Check, test, replace surface unit switch
E. Check, test, replace oven heater unit
F. Check, test, replace broiler heater unit
G. Check, test, replace oven thermostat and switch
H. Check, test, replace clock and timer
I. Check, test, replace lights and outlets

6.5 Electric Clothes Dryer

A. Use charts and manuals
B. Check, remove, replace cabinet parts
C. Check, remove, replace blower assembly
D. Check, remove, replace heaters
E. Check, test, replace switches and relays
F. Check, test, replace thermostats
G. Check, test, replace drive trains
H. Check, test, replace drum assembly and parts

6.6 Electric Dish Washer

A. Use charts and manuals
B. Remove, replace cabinet parts
C. Check, test, replace timer
D. Check, test, replace heater
E. Check, remove, repair, replace pump
F. Check, test, replace, adjust controls
G. Check, test, replace, repair drive train

6.7 Automatic Washer

A. Use charts and manuals
B. Disassemble and reassemble cabinet parts
C. Check, repair, replace drain pump
D. Check, test, replace fill valve
E. Check, test, replace timer
F. Check, test, replace controls
G. Check, test, replace drive train
H. Check, remove, replace tub assembly

6.8 Trash Compacter

A. Use charts and manuals
B. Remove, replace cabinet parts
C. Check, test, remove, replace start switch and key lock safety switch
D. Check, test, remove, replace drawer safety limit switches
E. Check, test, remove, replace top limit and directional switch

F. Check, test, remove, replace drive motor
G. Check, remove, replace drive mount assembly
H. Check, remove, replace ram assembly
I. Check, remove, replace power screw and sprocket assembly
J. Check, test, remove, replace spray can actuator assembly
K. Check, remove, replace drawer slides, rollers and container latch

6.9 Microwave Oven

A. Use charts and manuals
B. Check, test, replace protective door switches
C. Identify, check, replace door seals
D. Check, test, remove, replace timer
E. Check, test, remove, replace power selector
F. Check, test, replace start switch
G. Check, test, remove, replace cook relay
H. Check, test, replace cook indicator and dial light
I. Check, test, remove, replace fan motor assembly
J. Check, test, remove, replace stirrer motor and blade
K. Check, test, remove, replace power transformer
L. Check, test, remove, replace H.V. capacitor
M. Check, test, remove, replace magnetron
N. Review Dept. of Radiological Health maximum leakage Safety Standards, test and evaluate unit

7.1 Refrigeration Principles

A. Refrigerants
B. Pressure - Temperature Relationships
C. Refrigeration Cycle
D. Electrical Systems and Components
E. Applications: coolers, refrigerators, freezers, ice makers, air conditioners, vending machines

8.1 Hydraulic Systems

A. Fundamentals
B. Graphic symbols
C. Pressure - force - area
D. Cylinder actuators
E. Flow and its effect
F. Hydraulic devices
G. Drawing schematics
H. Maintainance

9.1 Pneumatic Systems

A. Fundamentals
B. Graphic symbols
C. Compressors
D. Conditioning of compressed air
E. Air regulation and measuring devices
F. Air control devices
G. Drawing schematic diagrams
H. Maintainance

10.1 Robotics

A. Fundamentals
B. Robot arm movement
C. Robot arm axis movement
D. Types and classifications of robots
E. Industrial sensors
F. Drive systems
G. Control systems
H. Programming and robot operation
I. Applications

11.1 Electro-Mechanical Systems

A. Classifications
B. Operations
C. Applications

12.1 Manuals - Bulletins - Diagrams

A. Types
B. Uses
C. Application
D. Sources

13.1 Installations

A. Delivery
B. Handling
C. Hook-up
D. Demonstration

14.1 Trouble Shooting

A. Analyze problem
B. Procedures
C. Repair or replace

15.1 Preventive Maintenance

A. Manufacturer's specifications
B. Scheduling Procedures

16.1 Customer Relations and Business Practices

A. Dress and appearance - first impressions
    1. clothing
        a. neat
        b. clean
    2. personal appearance
        a. cleanliness
        b. personal hygiene
        c. manners
            1. polite
            2. tactful

B. Courtesy to the customer
    1. telephone communication
        a. courteous
        b. sincere
        c. listen
        d. never argue, but stand on fact
        e. misunderstanding produces ill will
    2. association in person
        a. call customer by name
        b. pronounce name correctly
        c. efficient service
        d. brief, thorough
        e. satisfy complaints
        f. enthusiasm about company
        g. enthusiasm about product

C. Customer psychology
   1. Get the customer's story
   2. Agreement precedes disagreement
   3. Knowledge of equipment
   4. Ignorance kills customer confidence
   5. show initiative

D. Business practices
   1. Maintain good records
      a. customer files
      b. service calls
      c. time spent
      d. billings
      e. parts used
      f. correspondence
      g. inventory
      h. service bulletins
      i costs (all costs)
      j. taxes (all taxes)
      k. gross income
      l. net profits.

E. Ethics
   1. workmanship
   2. parts costs
   3. labor costs
   4. overhead costs
   5. promptness
   6. contractual and implied obligations
   7. customer consideration

ELECTRO-MECHANICAL

EXPLORATORY COURSE OUTLINE

The following format is basic to the Exploratory Programs in all trades. The content in each individual outline has been selected by the Curriculum Committee. Emphasis is placed on short-term manipulative exploratory experiences. The intent of the format is not to define rigid lines for operation, it should, however, be followed as closely as possible to insure that each exploratory student is provided with experiences which will aid in making an intelligent selection of a trade.

FORMAT:

A. 1st Day - A.M. - Orientation

1. Roll call
2. Seating plan
3. Shop clothing
4. Safety (glasses, etc.)
5. Locker assignment
6. Shop regulations
7. Departmental tour
8. Issue instructional supplies pertinent to trade.
9. Student notebooks
10. Shop making procedures

B. 1st Day - P.M. - Manipulative exploratory experiences

1. Demonstration by instructor
2. Student participation in skill learning experience
3. Assignment of job or project
4. Clean-up
5. Question and answer period

FORMAT (Cont'd)

C. 2nd Day - A.M. -
1. History of the trade
2. Theory related to skill assignment

P.M.
3. Skill assignment
4. Clean-up
5. Questions and answers

D. 3rd Day - A.M. -
1. Present opportunities in the trade
2. Theory related to skill assignment
3. Skill assignment

P.M.
4. Skill assignment
5. Clean-up
6. Advanced skill demonstration by instructor
7. Questions and answers

E. 4th Day - A.M. -
1. Future trade opportunities
2. Theory related to skill assignment
3. Skill assignment

P.M. -
4. Skill assignment
5. Advanced skill demonstration by instructor
6. Questions and answers

F. 5th Day - A.M. -
1. Theory related to skill assignment
2. Skill assignment
3. Advanced skill demonstration by instructor

P.M. -
4. Clean-up
5. Evaluation of weeks' activities
   a. Written test of content taught for purposes of ranking students in class.
   b. An evaluation of activities by students - student reaction.

FORMAT (Cont'd)

G. 6th Day - A.M. -	1.	Review test of week #1
	2.	Preparation for field trip Field trip if appropriate: or continued trade theory
	3.	Skill assignment
P.M. -	4.	Clean-up
	5.	Questions and answers
H. 7th Day - A.M. -	1.	Theory related to skill assignment
	2.	Skill assignment
P.M. -	3.	Skill assignment
	4.	Clean-up
	5.	Review and assign, student home preparation reports.
I. 8th Day - A.M. -	1.	Advanced skill demonstration by instructor
	2.	Theory related to skill assignment
P.M.	3.	Skill assignment
	4.	Clean-up
	5.	Students' reports on home assignments
J. 9th Day - A.M. -	1.	Advanced skill demonstration by instructor
	2.	Theory related to skill assignment
P.M.	3.	Skill assignment
	4.	Clean-up
	5.	Questions and answers
K. 10th Day - A.M.	1.	Student completion of skill assignment
	2.	Testing of students
	3.	Students evaluate and react to the trade (Not the course or teacher)
P.M.	4.	Clean-up and empty out lockers
	5.	Turn in instruction supplies
	6.	Students proceed to next shop
	7.	Accept new students

STATE DEPARTMENT OF EDUCATION
Division of Vocational, Technical and Adult Education

_____

_____

PROGRESS RECORD FOR
NINTH GRADE TRADE-EXPLORATORY STUDENTS

SHOP WORK ONLY

Student_____Exploratory Trade_____

Exploratory Period_____Beginning_____Ending _____

School Year: 19_____ - 19 _____

Shop Instructor Rating Student:_____

STUDENT'S RATING SCALE

G - GOOD A - AVERAGE P - POOR

G	A	P	GENERAL TRADE FACTORS	G	A	P	SPECIFIC TRADE FACTORS
			Occupational Information				
			Tools of the Trade				
			Use and Care of Tools				
			Projects				
G	A	P	INTEREST FACTORS	G	A	P	APTITUDE FACTORS
			Attendance				Handling of Tools
			Dependability				Initiative
			Industry				Learnability
			Persistence				Assurance
			Job Pride				Comprehension
			Attentiveness				Adjustment
			Attitude (Work)				Work Habits
			Attitude (Theory)				Production
			Cooperation (Instructor)				Judgment
			Cooperation (Students)				

Considering all the factors I would say the student's chances for success in

the_____trade are:_____

Comments:

OFFICE - WHITE
INSTRUCTOR - YELLOW
PARENT - PINK

CONNECTICUT'S COMMON CORE OF LEARNING

The following section contains the components of Connecticut's Common Core of Learning.

Analysis of the CCL. Each component was analyzed by the Steering Committee to determine (1) if the component is appropriate and applicable to the Vocational-Technical School System; (2) if instruction related to the component is the primary, shared, or no responsibility of the Electro-Mechanical program; and (3) if the component is being emphasized throughout the VT experience. The results of the committee's deliberations are reflected by the Xs in the appropriate columns.

Correlation of the CCL. The Steering Committee identified key components which are appropriate to the VT Schools, at least a shared responsibility of Electro-Mechanical, and which may not have been receiving attention. Those components were incorporated into the anticipated student outcomes and activities.

As is true with any instructional program, many of the components presented in Connecticut's Common Core of Learning are introduced and developed during the normal course of events. The key components mentioned above are the components which will receive concentrated attention. At the time of the next review of the Electro-Mechanical Curriculum it is probable that new components will be identified as needing that concentrated attention.

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
Attributes and Attitudes					
Positive Self-Concept					
As part of education in grades K-12, each student should be able to:					
1. Appreciate his/her worth as a unique and capable individual and exhibit self-esteem;	X			X	
2. Develop a sense of personal effectiveness and belief in his/her ability to shape his/her future;	X			X	
3. Develop an understanding of his/her strengths and weaknesses and the ability to maximize strengths and rectify or compensate for weaknesses.	X			X	
Motivation and Persistence					
As part of education in grades K-12, each student should be able to:					
1. Experience the pride of accomplishment that results from hard work and persistence;	X			X	
2. Act through a desire to succeed rather than a fear of failure, while recognizing that failure is a part of everyone's experience;	X			X	
3. Strive toward and take the risks necessary for accomplishing tasks and fulfilling personal ambitions.	X			X	
Responsibility and Self-Reliance					
As part of education in grades K-12, each student should be able to:					
1. Assume the primary responsibility for identifying his/her needs and setting reasonable goals;	X			X	
2. Initiate actions and assume responsibility for the consequences of those actions;	X		X		
3. Demonstrate dependability;	X		X		
4. Demonstrate self-control.	X		X		

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
Intellectual Curiosity					
As part of education in grades K-12, each student should be able to:					
1. Demonstrate a questioning attitude, open-mindedness and curiosity;	X			X	
2. Demonstrate independence of thought necessary for leadership and creativity;	X			X	
3. Pursue lifelong learning.	X			X	
Interpersonal Relations					
As part of education in grades K-12, each student should be able to:					
1. Develop productive and satisfying relationships with others based upon mutual respect;	X			X	
2. Develop a sensitivity to and an understanding of the needs, opinions, concerns and customs of others;	X			X	
3. Participate actively in reaching group decisions;	X			X	
4. Appreciate the roles and responsibilities of parents, children and families.		X			X
Sense of Community					
As part of education in grades K-12, each student should be able to:					
1. Develop a sense of belonging to a group larger than friends, family and co-workers	X			X	
2. Develop an understanding of the importance of each individual to the improvement of the quality of life for all in the community;	X			X	
3. Examine and assess the values, standards and traditions of the community;	X			X	

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
4. Understand and appreciate his/her own historical and ethnic heritage as well as that of others represented within the larger community.	X			X	
Moral and Ethical Values					
As part of education in grades K-12, each student should be able to:					
1. Recognize the necessity for moral and ethical conduct in a society;	X			X	
2. Recognize that values affect choices and conflicts;	X			X	
3. Develop personal criteria for making informed moral judgments and ethical decisions.	X			X	
Skills and Competencies					
Reading					
As a result of education in grades K-12, each student should be able to:					
1. Identify and comprehend the main and subordinate ideas, details and facts in written work and summarize the ideas in his/her own words;	X			X	
2. Identify, comprehend and infer comparisons, contrasts, sequences and conclusions in written work;	X			X	
3. Recognize different purposes and methods of writing, identify a writer's point of view and tone, and interpret a writer's meaning inferentially as well as literally;	X			X	
4. Set purposes, ask questions and make predictions prior to and during reading and draw conclusions from reading;	X			X	

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
5. Make critical judgments about written work including separating fact from opinion, recognizing propaganda, stereotypes and statements of bias, recognizing inconsistency and judging the validity of evidence and sufficiency of support;	X			X	
6. Vary his/her reading speed and method based on the type of material and the purpose for reading;		X			X
7. Use the features of books and other reference materials, such as table of contents, preface, introduction, titles and subtitles, index, glossary, appendix and bibliography.	X			X	
Writing					
As a result of education grades K-12, each student should be able to:					
1. Write standard English sentences with correct sentence structure, verb forms, punctuation, capitalization, possessives, plural forms, word choice and spelling;	X			X	
2. Select, organize and relate ideas and develop them in coherent paragraphs;	X			X	
3. Organize sentences and paragraphs into a variety of forms and produce writing of an appropriate length using a variety of composition types;	X			X	
4. Use varying language, information, style and format appropriate to the purpose and the selected audience;	X			X	
5. Conceive ideas and select and use detailed examples, illustrations, evidence and logic to develop the topic;	X			X	

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
6. Gather information from primary and secondary sources; write a report using that information; quote, paraphrase and summarize accurately; and cite sources properly;	X		X		
7. Improve his or her own writing by restructuring, correcting errors and rewriting.	X		X		
Speaking, Listening and Viewing					
As a result of education in grades K-12, each student should be able to:					
1. Engage critically and constructively in an oral exchange of ideas;	X		X		
2. Ask and answer questions correctly and concisely;	X		X		
3. Understand spoken instructions and give spoken instructions to others;	X		X		
4. Distinguish relevant from irrelevant information and the intent from the details of an oral message;	X		X		
5. Identify and comprehend the main and subordinate ideas in speeches, discussions, audio and video presentations, and report accurately what has been presented;	X		X		
6. Comprehend verbal and nonverbal presentations at the literal, inferential and evaluative levels;	X			X	
7. Deliver oral presentations using a coherent sequence of thought, clarity of presentation, suitable vocabulary and length, and nonverbal communication appropriate for the purpose and audience.	X		X		

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
Quantitative Skills					
As a result of education in grades K-12, each student should be able to:					
1. Add, subtract, multiply and divide using whole numbers, decimals, fractions and integers;	X		X		
2. Make and use measurements in both traditional and metric units to measure lengths, areas, volumes, weights, temperatures and times;	X		X		
3. Use ratios, proportions and percents, powers and roots;	X		X		
4. Understand spatial relationships and the basic concepts of geometry;		X			X
5. Make estimates and approximations, and judge the reasonableness of results;	X		X		
6. Understand the basic concepts of probability and statistics;		X			X
7. Organize data into tables, charts and graphs, and read and interpret data presented in these forms;	X		X		
Reasoning and Problem Solving					
As a result of education in grades K-12, each student should be able to:					
1. Recognize and use inductive and deductive reasoning, recognize fallacies and examine arguments from various points of view;	X		X		
2. Draw reasonable conclusions from information found in various sources, and defend his/her conclusions rationally;	X		X		
3. Formulate and test predictions and hypotheses based on appropriate data;	X		X		
4. Comprehend, develop and use concepts and generalizations;	X		X		
5. Identify cause and effect relationships;	X		X		

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
6. Identify and formulate problems;	X			X	
7. Gather, analyze, synthesize and evaluate information pertinent to the problem;	X			X	
8. Develop alternative solutions to problems, weigh relative risks and benefits, make logical decisions and verify results;	X			X	
9. Use critical and creative thinking skills to respond to unanticipated situations and recurring problems.	X			X	
Learning Skills					
As a result of education in grades K-12, each student should be able to:					
1. Set learning goals and priorities consistent with stated objectives and progress made, and allocate the time necessary to achieve them;	X		X		
2. Determine what is needed to accomplish a task and establish habits conducive to learning independently or with others;	X			X	
3. Follow a schedule that accounts for both short and long term project accomplishment;	X		X		
4. Locate and use a variety of sources of information including print and nonprint materials, computers and other technologies, interviews and direct observations;	X		X		
5. Read or listen to specific information and take effective and efficient notes.	X		X		

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
Understanding and Applications					
The Arts: Creative and Performing					
As a result of education in grades K-12, each student should be able to:					
1. Express his/her own concepts, ideas and emotions through one or more of the arts (art, music, drama and dance);		X			X
2. Appreciate the importance of the arts in expressing and illuminating human experiences;		X			X
3. Understand that personal beliefs and societal values influence art forms and styles;	X			X	
4. Identify the materials, processes and tools used in the production, exhibition and public performance of works of art, music, drama and dance;	X			X	
5. Use and understand language appropriate to each art form when discussing, critiquing and interpreting works in the visual and performing arts;		X			X
6. Identify significant works and recognize the aesthetic qualities of art, music, drama and dance from different historical periods and cultures.		X			X
Careers and Vocations					
As a result of education in grades K-12, each student should be able to:					
1. Demonstrate positive attitudes toward work, including acceptance of the necessity of making a living and an appreciation of the social value and dignity of work;	X		X		
2. Demonstrate attitudes and habits (such as pride in good workmanship, dependability and regular attendance) and the employability skills and specialized knowledge that will make the individual a productive participant in economic life and a contributor to society;	X		X		

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
3. Consider the range of occupations that will be personally satisfying and suitable to his/her skills, interests and aptitudes;	X		X		
4. Identify, continue or pursue the education and training necessary for his/her chosen career/vocation;	X			X	
5. Understand personal economics and its relationship to skills required for employment, promotion and financial independence;	X			X	
6. Exhibit the interpersonal skills necessary for success in the workplace (such as working harmoniously as part of a team, and giving and taking direction).	X			X	
Cultures and Languages					
As a result of education in grades K-12, each student should be able to:					
1. Recognize characteristics common to all people, such as physical attributes, emotional responses, attitudes, abilities and aspirations;	X		X		
2. Respect differences among people and recognize the pluralistic nature of United States society;	X		X		
3. Demonstrate an understanding of other cultures and their roles in international affairs;		X			X
4. Analyze the structure of spoken and written language;	X			X	
5. Recognize the commonalities and the differences that exist in the structure of languages;		X			X
6. Understand and communicate in at least one language in addition to English.		X			X

History and Social Sciences

As a result of education in grades K-12, each student should be able to:

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
1. Recognize and analyze events, personalities, trends and beliefs that have shaped the history and culture of Connecticut, the United States and the world;		X			X
2. Demonstrate a knowledge of United States history and government and understand the duties, responsibilities and rights of United States citizenship;		X			X
3. Understand the basic concepts of economics;	X			X	
4. Analyze and compare the political and economic beliefs and systems of the United States with those of other nations;	X			X	
5. Apply major concepts drawn from the disciplines of history and the social sciences--anthropology, economics, geography, law and government, philosophy, political science, psychology and sociology--to hypothetical and real situations;		X			X
6. Demonstrate basic knowledge of world geography;		X			X
7. Apply critical thinking skills and knowledge from history and the social sciences to the decision-making process and the analysis of controversial issues in order to understand the present and anticipate the future;		X			X
8. Understand the roles played by various racial, ethnic and religious groups in developing the nation's pluralistic society;		X			X
9. Appreciate the mutual dependence of all people in the world and understand that our lives are part of a global community joined by economic, social, cultural and civic concerns.	X			X	

37

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
Literature					
As a result of education in grades K-12, each student should be able to:					
1. Understand that literature reflects and illuminates human experiences, motives, conflicts and values;		X			X
2. Understand the essential elements of poetry, drama, fiction and nonfiction;		X			X
3. Understand and appreciate selected literary masterpieces, both past and present, that manifest different value systems and philosophies;		X			X
4. Recognize symbolism, allegory and myth;		X			X
5. Identify literary themes and their implications;		X			X
6. Evaluate selected literary works and support each evaluation;		X			X
7. Enjoy reading as a lifelong pursuit.	X		X		
Mathematics					
As a result of education in grades K-12, each student should be able to:					
1. Understand that mathematics is a means of expressing quantifiable ideas;	X		X		
2. Apply mathematical knowledge and skills to solve a broad array of quantitative, spatial and analytical problems;	X		X		
3. Use mathematical skills and techniques to complete consumer and job-related tasks;	X		X		
4. Select and use appropriate approaches and tools for solving problems, including mental computation, trial and error, paper and pencil, calculator and computer;	X		X		
5. Use mathematical operations in describing and analyzing physical and social phenomena;		X			X

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
6. Demonstrate a quantitative sense by using numbers for counting, measuring, comparing, ordering, scaling, locating and coding;	X			X	
7. Apply basic algebraic and geometric concepts to representing, analyzing and solving problems;	X			X	
8. Use basic statistical concepts to draw conclusions from data.	X			X	
Physical Development and Health					
As a result of education in grades K-12, each student should be able to:					
1. Understand human growth and development, the functions of the body, human sexuality and the lifelong value of physical fitness;			X		X
2. Plan and implement a physical fitness program with a variety of conditioning exercises and/or leisure activities;			X		X
3. Understand the basic scientific principles which apply to human movement and physical activities;			X		X
4. Understand the role physical activities play in psychological and social development;			X		X
5. Understand and apply the basic elements of proper nutrition, avoidance of substance abuse, prevention and treatment of illness, and management of emotional stress;	X			X	
6. Recognize the need for a safe and healthy environment, practice proper safety skills, and demonstrate a variety of basic life saving skills.	X			X	

Science and Technology

As a result of education in grades K-12, each student should be able to:

	APPROPRIATE	INAPPROPRIATE	RESPONSIBILITY		
			PRIMARY	SHARED	NONE
1. Understand and apply the basic principles, concepts and language of biology, chemistry, physics, earth and space science;	X			X	
2. Understand the implications of limited natural resources, the study of ecology and the need for conservation;	X			X	
3. Identify and design techniques for recognizing and solving problems in science, including the development of hypotheses and the design of experiments to test them--the gathering of data, presenting them in appropriate formats, and drawing inferences based upon the results;	X			X	
4. Use observation and analysis of similarities and differences in the study of natural phenomena;	X			X	
5. Demonstrate the ability to work with laboratory measuring, manipulating and sensing devices;	X		X		
6. Understand the implications of existing and emerging technologies on our society and our quality of life, including personal, academic and work environments;	X		X		
7. Recognize the potential and the limitations of science and technology in solving societal problems.	X		X		

STUDENT RECORD BOOK

The objective of this book is to reduce the shop instructor's paper work while planning student job assignments.

This book is designed to advance with the class, from permanent ninth grade students through grade twelve. Students completing the major objectives set forth in this book will be ready to enter industry as advanced apprentices.

It is the responsibility of the instructor to apply the contents of this book as well as to draw on his/her own experience to be sure that the students are alerted to and practice all safety procedures required for each job.

In shops doing production work, it is significant to plan by the day although in some instances, it is only projected concepts. Planning and organizing for shop instruction should be done in advance of students entering the shop for a new instructional cycle.

Note that this book is designed not only for planning. It also has columns for locker assignments, text assignments, notes, etc. The student's name is entered only once for the entire course of study.

STUDENT INFORMATION

Grade_____Year_____Instructor_____

STUDENT	Locker No.	Textbook No.	Shop Grades Marking Period 1	2	3	4	F	Theory Grades Marking Period 1	2	3	4	F

42

STUDENT INFORMATION

Grade_____Year_____Instructor_____

STUDENT		Locker No.	Textbook No.	Shop Grades Marking Period					Theory Grades Marking Period				
				1	2	3	4	F	1	2	3	4	F

STUDENT INFORMATION

Grade_____Year_____Instructor_____

STUDENT	Locker No.	Textbook No.	Shop Grades Marking Period 1	2	3	4	F	Theory Grades Marking Period 1	2	3	4	F

STUDENT INFORMATION

Grade_____Year_____Instructor_____

STUDENT	Locker No.	Textbook No.	Shop Grades Marking Period 1	2	3	4	F	Theory Grades Marking Period 1	2	3	4	F

STUDENT INFORMATION

Grade_____ Year_____ Instructor_____

STUDENT	Locker No.	Textbook No.	Shop Grades Marking Period 1	2	3	4	F	Theory Grades Marking Period 1	2	3	4	F

46

STUDENT

1.1 EXPLORATORY ORIENTATION
Career
Shop Rules and Regulations
Safety
Mechanical
2.1 ELECTRON PHYSICS
Define Terms
State Electrical Charges
Identify by Valence

STUDENT

2.2 BASIC CONCEPTS OF ELECTRICITY
Like and unlike Charges
Sources of Electricity
Meaning of voltage Ohm, Ampere, Watt
Ohm's Law
Magnetism
Meters
Protective Devices
Reading, Drawing and Interpreting Diagrams
Series Circuits
Parallel Circuits
Series-Parallel Circuits
Conductors and Insulators
Electro-Magnetism
Solenoids
Relays and Magnetic Switches

STUDENT	2.2 BASIC CONCEPTS OF ELECTRICITY (CONT.)	Control Devices	National Electrical Code						3.1 SEMICONDUCTORS	Diodes	Transistors	Integrated circuits	Symbols				

STUDENT	3.2 RECTIFICATION (POWER SUPPLIES)	Half-wave	Full-wave	Bridge	Filters	Regulation				3.3 D.C. GENERATORS	Principles of Operation	Types	Circuit Application			

STUDENT	3.4 D.C. MOTORS	Principles of Operation	Types	Circuit Application				4.1 A.C. FUNDAMENTALS	Generation of A.C.	Lenz's Law and effects	Inductance	Capacitance					

STUDENT	4.2 A.C. MOTORS	Principles of operation	Types	Circuit application				4.3 CAPACITORS	Construction	Uses	Testing	Discharging and Charging	Circuit Application			

STUDENT

4.4 PRINCIPLES OF TRANSFORMERS
Construction
Connections
Primary and secondary circuit relations
Volt, AMP relations
Step-up and Step-down
4.5 MOTOR CONTROLS
Magnetic Control
Relays
S.C.R. Controls
Thermostatic Control
Mechanical Control
Braking

STUDENT	5.1 DRIVES	Driver and Driven	Pulleys and Gears	Speed Relations Belt	Belt Types and Characteristics	Friction Drives	Transmissions				5.2 CAMS AND LEVERS	Types	Uses				

STUDENT	5.3 LUBRICANTS	Types	Uses and Applications					5.4 SPRINGS	Classification	Application					6.1 GASES	Sources and Types	Characteristics	Mixtures

STUDENT	6.1 GASES (CONT.)	Orifices	Ventilation	Draft	Heat and Effects	Valves			6.2 Electric Heating	Types	Uses					

STUDENT

6.3 ELECTRIC HOT WATER HEATER
Use charts and manuals
Wire Electric Water Heater
Check, test, replace heater elements
Check, test, replace heater controls

| STUDENT | 6.4 ELECTRIC RANGE | | |

STUDENT

6.5 ELECTRIC CLOTHES DRYER	
Use charts and manuals	
Check, remove, replace cabinet parts	
Check, remove, replace Blower Assembly	
Check, test, replace Heaters	
Check, test, replace switches & relays	
Check, test, replace thermostats	
Check, test, replace drive trains	
Check, test, replace drum assembly & parts	

STUDENT

6.6 ELECTRIC DISH WASHERS
Use charts and manuals
Remove, replace cabinet parts
Check, test, replace timer
Check, test, replace heater
Check, remove, repair, replace pump
Check, test, replace, adjust controls
Check, test, replace, repair drive train

09 60

STUDENT	6.7 AUTOMATIC WASHER
	Use charts and manuals
	Disassemble and re-assemble cabinet parts
	Check, repair replace drain pump
	Check, test, replace fill valve
	Check, test, replace timer
	Check, test, replace controls
	Check, test, replace drive train
	Check, Remove, Replace tub assembly

STUDENT	6.8 TRASH COMPACTOR
	Use charts and manuals
	Remove, replace, cabinet parts
	Check, replace, start sw., key lock switch
	Check, replace drawer safety limit switch
	Check, replace top limit, directional sw.
	Check, test, replace drive motor
	Check, replace drive mount assembly
	Check, replace RAM assembly
	Check, replace power screw & sprocket asmbl
	Check, replace spray can actuator assembly
	Check, replace drawer slides, rollers & container latch assembly
	Check, test, replace drive motor

STUDENT

6.9 MICROWAVE OVEN
Use charts and manuals
Check, replace protective door switches
Identify, replace door seals
Check, replace timer
Check, replace power selector
Check, test start switch
Check test cook relay
Check test cook indicator & dial light
Check, replace fan motor assembly
Check, replace stirrer motor & blade
Check, replace power transformer
Check, replace H.V. capacitor
Check, replace magnetron
Review federal safety maximum leakage standards, test and evaluate unit

STUDENT

7.1 REFRIGERATION PRINCIPLES
Pressure-temperature refrigerants
Refrigeration cycle
Electrical systems and components
Application - coolers refrigerators, freezers
Ice making machines, air conditioners
vending machines
8.1 HYDRAULIC SYSTEMS
Fundamentals
Graphic symbols
Pressure - force - area
Cylinder actuators
Flow and its effect
Hydraulic devices
Drawing schematics

STUDENT •

8.1 REFRIGERATION (CONTINUED)
Maintainance
9.1 PNEUMATIC SYSTEMS
Fundamentals
Graphic Symbols
Compressors
Conditioning of compressed air
Air regulation and measuring devices
Air control devices
Drawing schematic diagrams
Maintainance

STUDENT	10.1 ROBOTICS	Fundamentals	Robot arm movements	Robot arm axis movements	Types and classifications of robots	Industrial sensors	Drive systems	Control systems	Programming and robot operation	Applications				11.1 ELECTRO-MECH. SYSTEMS & EQUIPMENT	Classifications	Operations	Applications

STUDENT				12.1 MANUALS BULLETINS DIAGRAMS	Types	Uses	Application	Sources					13.1 INSTALLATIONS	Delivery	Handling	Hook-up	

STUDENT	Demonstration label				14.1 TROUBLE SHOOTING	Analyze problem	Procedures	Repair or Replace				15.1 PREVENTIVE MAINTENANCE	Manufacturer's specifications	Scheduling procedures		

STUDENT	16.1 CUSTOMER RELATION & BUSINESS PRACTICES
	Dress and appearance
	Courtesy to the customer
	Customer psychology
	Business practices
	Ethics

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RESOURCES

AUDIO/VISUAL	Bergwall E12-E8	Basic Electricity Direct Current *
(filmstrips)	Bergwall 801	Basic Electricity & Electronics - DC
	Bergwall 802	Basic Electricity & Electronics - AC
	Bergwall 805	Reactive Circuits
	Bergwall 806	Power Supplies
	Bergwall 807	Transistors
	Bergwall 808	Transistors II
	Bergwall E13	Understanding Digital Electronics
	Bergwall 850	Digital Electronics Explained
	Bergwall 851	Digital Electronics Explained II
	Bergwall 865	Soldering For Electronics Repair
	Bergwall 870	Digital Codes & Numbering Systems
	Bergwall 873	Microchip Technology
	Bergwall 874	Microcomputer Circuits Explained
	Bergwall 883	Programmable Controllers Explained

*Note: Many Bergwall filmstrips are also available on VHS video.
Check with manufacturer or vendor for availability.

RESOURCES

AUDIO/VISUAL	Bergwall	Troubleshooting IBM
(Videotapes)	Bergwall	Apple II Repair
	Bergwall	Automotive Microprocessors
	Bergwall	Logic Gates
	PACE	Soldering Series
	Teaching Aids	Electrical Safety in the Shop L-090501V
	Teaching Aids	Electronics: Schematic Symbols L-12-5004V